Director of
Central
Intelligence

Potential for the Transfer of US Space Technology to the Soviet Union

National Intelligence Estimate
Volume I—Key Judgments and Summary

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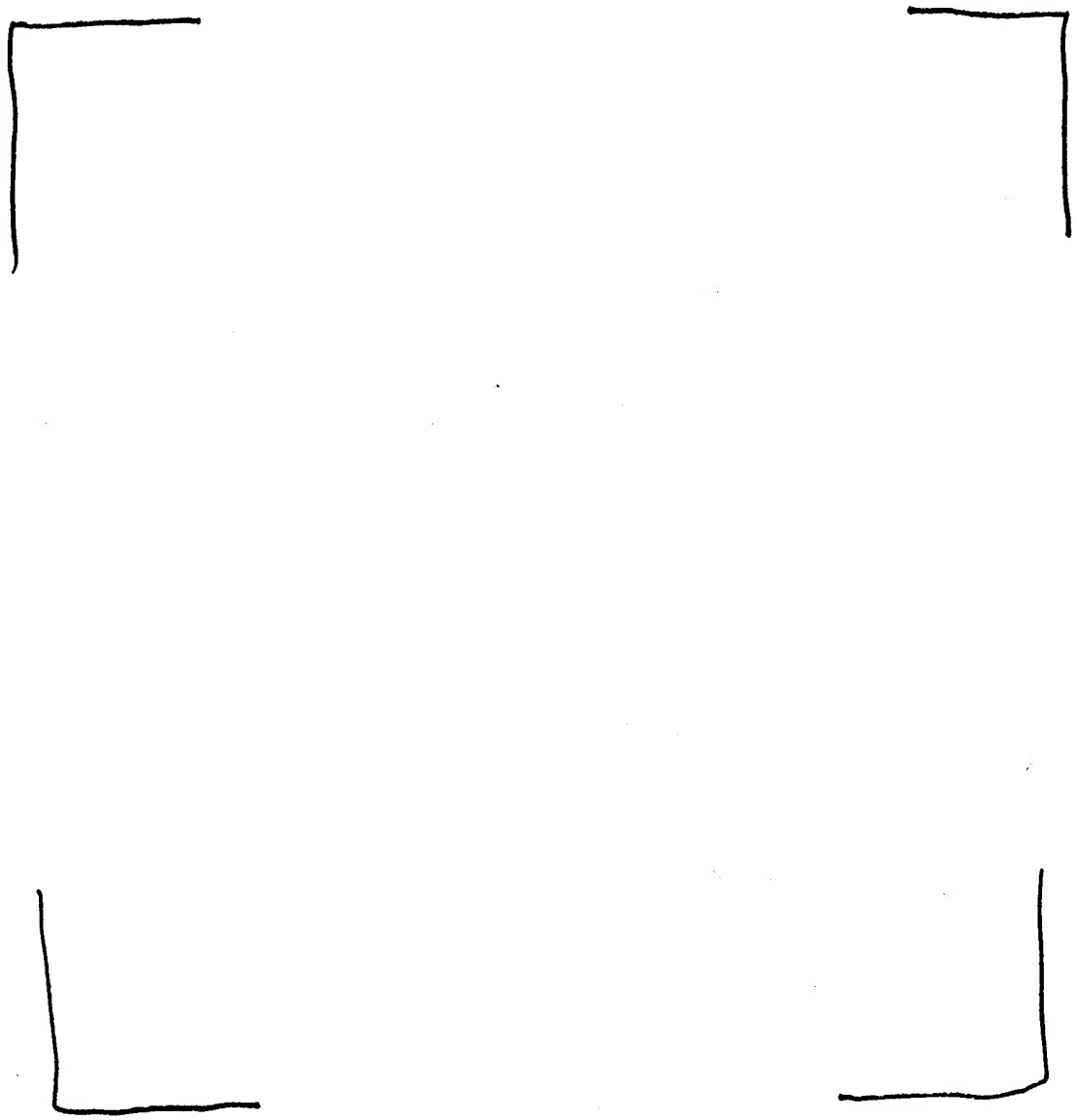

NIE 11-1/7-84

POTENTIAL FOR THE TRANSFER OF US SPACE TECHNOLOGY TO THE SOVIET UNION

VOLUME I—KEY JUDGMENTS AND SUMMARY

Information available as of 6 November 1984 was used in the preparation of this Estimate, which was approved by the National Foreign Intelligence Board on 21 November 1984.

THIS ESTIMATE IS ISSUED BY THE DIRECTOR OF CENTRAL INTELLIGENCE.

THE NATIONAL FOREIGN INTELLIGENCE BOARD CONCURS, EXCEPT AS NOTED IN THE TEXT.

The following intelligence organizations participated in the preparation of the Estimate:

The Central Intelligence Agency, the Defense Intelligence Agency, the National Security Agency, and the intelligence organizations of the Departments of State and the Treasury.

Also Participating:

The Assistant Chief of Staff for Intelligence, Department of the Army

The Director of Naval Intelligence, Department of the Navy

The Assistant Chief of Staff, Intelligence, Department of the Air Force

The Director of Intelligence, Headquarters, Marine Corps

SCOPE NOTE

The evolving plans for greater cooperation between the US Civil Space Program and those of US allies in Western Europe and Japan have given rise to concerns about possible technological leakage to the USSR. The projected joint programs could involve the sharing of research and development information, advanced manufacturing techniques, and operational support in programs such as the space station.

This Estimate assesses the possible military-related benefits that the USSR could derive from the transfer of specific US space technologies and identifies what we perceive to be the key Soviet needs related to space technology. It also describes the Soviet program to acquire Western technology, the methods used, and the contributions that Western space technology have made to certain Soviet military programs and military-related space programs.

The Estimate also assesses the competence and vulnerabilities of the Soviet acquisition program, the prospects for the loss of US technology by means of the joint space programs, and countermeasures to reduce these prospective losses. There are also assessments of the intelligence gaps and the limitations that affect this Estimate.

Our conclusions are general and are intended to support the development of overall policies and guidelines concerning cooperative space efforts with US allies. Specific cases will have to be reviewed for technology transfer potential as they arise and the terms of cooperation and details of control agreements are determined.

This Estimate does not address the impact of not having cooperative space programs with US allies.

Our findings and analysis for this Estimate are in two volumes:

— Volume I : Key Judgments and Summary.

— Volume II: The Estimate.

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KEY JUDGMENTS

We believe that joint space programs between the United States and its allies will, under current conditions, serve as conduits for the increased leakage of sensitive US technology to the Soviets. These technologies would be applied directly to future Soviet military space and nonspace military systems developments. To be sure, a vast amount of valuable space-related technology already has been and continues to be obtained directly from US sources and used by the Soviets in applications ranging from their satellite data relay system to their developmental space transportation system. We expect that Western technology *not controlled* for national security, foreign policy, or competitive reasons will continue to be acquired by the Soviets. Our primary concern with respect to cooperative space programs with US allies is that the transfer to allies of *controlled*[1] US technology substantially increases its vulnerability to Soviet collectors. [

] the Soviet technology acquisition program is large, well organized, well funded, and has in place the means to collect both controlled and uncontrolled technologies—such means including espionage, trade diversions, and scientific exchange.

Our expectation for continued Soviet acquisition and use of US space technology is based, in part, on the record of Soviet activity in this area—activity that has already greatly benefited Soviet space and military space system developments:

— There are several instances where certain Soviet spacecraft systems and subsystems are so similar to US spacecraft systems or subsystems that we can confidently assess that they have at least benefited greatly from, if not actually copied, Western technology or systems. [

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[1] Controlled technology is technology included under the provisions of the Export Administration Act, the Munitions Act, the Atomic Energy Act, and COCOM. Foreign policy decisions may also control sales through embargo. For competitive reasons, some technologies are controlled as company proprietary information.

— We believe the Soviets acquired considerable information on the US shuttle orbiter's thermal protection system from the surface heating data obtained from the second and third shuttle flights. These data were released to the public in June 1982. NASA estimates that the data could save the Soviets the equivalent of $750 million in R&D cost and considerably reduce development time.

We estimate that Soviet attempts to acquire space technology will be in areas needed to support development of future systems or follow-ons to existing space and nonspace military systems rather than for systems in current production or in an advanced state of development. Current assessments of Soviet technological capability identify 13 technology areas that are critical to possible Soviet space programs. These 13 "space technology" areas affect some 75 space systems or system options for which we believe there are Soviet military needs and corresponding intelligence collection requirements. The Soviets probably will not be able to satisfy all of these requirements through access to US-allied cooperative space programs.

A number of countermeasures are available, some of which are being applied by the United States and to a lesser extent by the allies to protect sensitive technologies. With respect to the unclassified and uncontrolled technology, the most effective countermeasure is an awareness program coupled with security and distribution procedures to introduce uncertainty and time lags in the Soviet and East European technology acquisition process. As for trade, most key space-related hardware is already controlled, and efforts of COCOM members currently under way to reduce diversions will enhance COCOM's effectiveness, even if the measures are only partially successful. Counterespionage efforts by the West over the past two years have reduced, to some extent, the effectiveness of Moscow's clandestine technology acquisition operations.

The Soviets regard all acquisition of Western equipment and scientific and technical information in support of requirements set by their Military-Industrial Commission (VPK) as an intelligence operation, regardless of who collects it or how it is collected. These operations focus on technology that enhances Soviet military efforts, including space programs. Open-source publications (particularly NASA documents and NASA-funded contracted studies) constitute the Soviets' largest and most important source of US space technology. Soviet collection requirements that cannot be satisfied by open sources, exchanges, or legal purchases become clandestine targets to be reached by either illegal purchases or by traditional espionage methods.

Faced with the intensification of the military-technological competition with the United States, and the growing importance of the space arena, the Soviets will continue to increase their collection efforts to overcome Western controls covering space-related technology. Moreover, the proliferation of commercial space capabilities among the Western allies and the establishment of cooperative space programs with them will widen the available targets for Soviet access. It is possible that, as the Western allies develop and apply technology in their own space programs, they will become more cautious in their exchanges with the Soviets and more security conscious. It is likely, however, that the Soviet and East European S&T collectors will continue to find the allies to be inviting targets.

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SUMMARY

The Soviet program for acquiring Western technology is highly centralized, well funded, and supervised by the top political leadership. The basic aim is to increase the military power of the USSR, advance the quality of military and space technology, and modernize key industries. The strong military orientation of the acquisition program is reflected in the dominant role played by the Military-Industrial Commission (VPK), which coordinates the development and production of Soviet weapon systems and also supervises the acquisition and assimilation of military and dual-use Western technology.

The Soviets regard all acquisition of Western equipment and scientific and technical information in support of VPK requirements as an intelligence operation, regardless of who collects it or how it is collected. Consequently, the Soviets designate as collectors the Ministry of Foreign Trade, the Academy of Sciences, and many other Soviet institutions in addition to the KGB and the military intelligence organization (GRU). The East Europeans are increasingly involved in the collection program under Soviet tasking, and the Soviet intelligence services now consider Western Europe and Japan better sources of technology in many areas, and they find it easier to acquire US technology there than in the United States itself.

VPK requirements are issued to the collectors in great detail. The requirements generally identify the items sought, their collection priorities, how long each requirement is valid, the Soviet ministry that levied the requirement, the most likely sources of the technology, and the budget for each acquisition. The requirements encompass a broad spectrum of military hardware and related production technology and technical data. They probably are revised and updated annually.

The VPK periodically evaluates the results and benefits of the collection program in terms of ruble and time savings for Soviet programs.

We believe that the Soviets' military and nonmilitary space programs—for example, their developmental space transportation system (STS)—have clearly benefited from acquired Western space technology, including that from space programs. Apparently, the principal benefits the Soviets have derived from the data and equipment they have collected have been shortening of program development times and

the reduction of ruble expenditures for military-related space and other programs, the acceleration of technological development, the removal of technological obstacles, the introduction of new concepts and programs, the cancellation of programs already under way, and the evaluation of their technology relative to that of the West.

Open-source publications (particularly NASA documents and NASA-funded contractor studies) constitute the Soviets' largest and most important source of US space technology. In fact, we estimate that well over half of the Soviet intelligence services' acquisitions in the aerospace category have been unclassified. We believe such technical materials have been used directly in Soviet space-related R&D projects, ranging from the developmental STS to space medicine.

The largest category of unclassified NASA reports collected by the Soviets concerned the STS—particularly the design and construction of the STS shuttle orbiter.

On the basis of this reporting and construction activity at the production plants, we believe that in 1973-74 the Soviets made the decision to copy, with some modifications, the US shuttle orbiter.

We believe the Soviets acquired considerable information on the US shuttle orbiter's thermal protection system from the surface heating data obtained from the second and third shuttle flights. These data were released to the public in June 1982. NASA estimates that the data could save the Soviets the equivalent of $750 million in R&D cost and considerably reduce development time.

The Soviet intelligence services work closely with the State Committee for Science and Technology (GKNT) and the Academy of Sciences at times to support legal purchases of Western technology (for which normally scarce hard currency is made available) and scientific exchanges with Western universities and research centers. Through legal trade the Soviets have acquired key production technologies such as powder metallurgy and numerically controlled machine tools.

Soviet scientific cooperation with Western countries since the mid-1960s, particularly with the United States and France, is a significant source of technology transfer. Soviet and East European technical

delegations are generally of high quality and all are used for intelligence collection. Through social contacts, scientific meetings, and colloquiums as well as direct Soviet access to hardware and facilities, collection of militarily significant technology has been facilitated. For example, the Franco-Soviet space cooperation agreement has spanned two decades [ ] and recently has been renewed until 1993. [

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Soviet collection requirements that cannot be satisfied by open sources, exchanges, or legal purchases become clandestine targets to be reached by either illegal purchases or by more classic espionage methods. The Soviet intelligence services and the Ministry of Foreign Trade have developed fairly successful methods for diverting legal trade into illicit channels. We have identified some 300 companies operating from 30 countries that engage in illegal technology trade with the Soviets. Most of the goods we have identified in illegal trade are dual-use products, controlled by COCOM but diverted by Western brokers or by Soviet-controlled dummy companies in the West to destinations in the USSR. The Soviet space program has almost certainly obtained through illegal trade a sizable amount of high-quality microelectronics coating equipment, computer-aided design and manufacturing systems, lubricants, composite technology, advanced instrumentation (particularly Western mass spectrometers), and production technology for rocket engine casings, reactants for rocket fuels, and fiber-optic systems.

There are several instances where certain Soviet spacecraft systems and subsystems are so similar to US spacecraft systems or subsystems that we can confidently assess that the Soviets have at least benefited greatly from, if not actually copied, Western technology or systems.

[ ]

[ ] There are other Soviet systems, such as the developmental STS, discussed later in this report where there is clear evidence that the Soviets intended to copy the US systems.

The Soviets also monitor the communications of US defense contractors[ ] The Soviets can probably monitor the full range of US satellite-based communication, and they are expanding their intercept capabilities.

Soviet intelligence operations against Western space technology focus on classified and company proprietary information that will enhance the Soviet military space efforts. US companies involved in research on and the development and production of space technologies are the main target. NASA's headquarters and three of its associated research centers are also prime targets as are the large West European and Japanese firms and government agencies engaged in space activities. The volume of material collected by Soviet intelligence through clandestine means has been small compared with the vast amounts collected overtly, but we estimate that space technology acquired clandestinely has had a more direct and significant impact on Soviet military programs than acquisitions from other means when compared on an item-by-item basis. [ ]

[ ] Nevertheless, other mechanisms such as open-source collection have contributed more to the overall Soviet space effort through sheer volume of information collected.

We estimate that Soviet attempts to acquire space technology will be in areas needed to support development of future or follow-on systems rather than for systems in current production or in an advanced state of development. It is the practice in Soviet space and defense industry to require that the necessary technology be already proven before a decision is made to proceed with the development phase of a weapon program. Even though new technologies become available in the development phase, they are not used normally until a follow-on modification is undertaken. There is probably routinely a built-in lag of some five to 10 years between the acquisition of a new technology and its appearance in a fielded weapon system. The Soviets generally do not

develop a new system until they are sure of all the technology to be used. They have such confidence in Western technology, however, that they will accept and incorporate much of it without the extensive testing that accompanies an indigenous technological development. We have recent examples of technology being incorporated in a fielded weapon system within two to three years of its acquisition.

Current assessments of Soviet technological capability identify 13 technology areas that are critical to possible Soviet space programs. Some of these technologies, of course, will also be applicable to nonspace military programs. These 13 areas affect some 75 space systems or system options for which we believe there are Soviet military needs and corresponding intelligence collection requirements. The critical Soviet space technology areas are:

— Sensors.

— Microelectronics.

— Computers.

— Signal processing.

— Command and control (including artificial intelligence and robotics).

— Guidance and navigation.

— Power sources.

— Propulsion.

— Directed energy.

— Life support systems.

— Large structure technology.

— Material technology.

— Attitude control.

Future Soviet developments in space and other advanced military systems will also benefit from access to Western developments related to reliability, quality control, and manufacturing of complex equipment and supporting management procedures.

Faced with the intensification of the military-technological competition with the United States and the growing importance of the space arena, the Soviets will continue to increase their collection efforts to overcome Western controls covering space-related technology. Moreover, the proliferation of commercial space capabilities among the Western allies and the establishment of cooperative space programs with them widen the available targets for Soviet access. It is possible

that, as the Western allies apply sensitive technology in their space programs, they will become more cautious in their exchanges with the Soviets and more security conscious. It is likely, however, that the Soviet and East European S&T collectors will continue to find the allies to be inviting targets.

The USSR has begun to diversify its joint space programs for political reasons and for greater flexibility in acquiring Western technology. Termination of the US-Soviet planetary data exchange program has led the Soviets to seek closer cooperation with the European Space Agency (ESA), and Moscow is encouraging US scientists to maintain contacts with their Soviet counterparts through West European intermediaries. The USSR will be viewed as an attractive partner by West European scientists to the extent that Moscow offers programs of interest to them (such as lunar orbiters, a Mars chemical analysis orbiter, and missions to the outer planets). The Soviets will gain some propaganda benefit by presenting their programs as peaceful, scientific explorations, and will cultivate the good will of the European scientific community in order to gain access to new Western technology.

We believe that joint programs between the United States and its allies on the one hand, and between these allies and the USSR on the other, will under current conditions serve as conduits for the increased leakage of US technology to the Soviets. Our major concern with the joint US-allied space station project is that it will involve a transfer of US design know-how to the allies. As indicated by past performance, Moscow probably will succeed in opening a channel into the space station project through the allies and gain valuable insight into US design concepts.

A number of countermeasures are available, some of which are being applied by the United States and to a lesser extent by the allies to protect sensitive technologies. Counterespionage efforts by the West over the past two years have undoubtedly hurt Moscow's clandestine S&T operations. The West in this area has probably taken its most effective actions against Soviet acquisition. As for trade, most key space-related hardware is already controlled, and heightened awareness of the technology transfer problem and current efforts in the enforcement of export controls of COCOM should reduce diversions even if these countermeasures are only partially successful. Similarly, the cooperative efforts of law enforcement agencies against the relatively small number of known diverters of technology to the Soviets could be stepped up, and harsher penalties imposed.

A much more difficult area to control is technological transfer by individual scientists meeting with their Soviet and East European

counterparts. Western academic and scientific communities generally underestimate or ignore the intelligence functions of Soviet and East European students, engineers, and scientists and the potential for *technology* loss through *scientific* exchange. Awareness programs, visitor screening, and improved security procedures, including classification when appropriate, would be effective in controlling technology losses in this area.

The timely fulfillment of collection requirements is of central importance because the USSR's military and space R&D programs, for the most part, include only those Western technologies that are obtainable within the time constraints of its development plans. The key, therefore, to impeding the introduction of new, more complex, and capable Soviet space systems that require significant contributions of Western technology is to increase the designers' uncertainty that this technology will be available at the time the pivotal development decisions have to be made. A move to introduce more delay and uncertainty into the data flow could impose on the Soviets—given their practice of selecting proven technologies for applications early in the development of new systems—a greater expenditure of their own resources, a loss in systems capability, or a delay in meeting their goals.

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